The Mechanic.

DECEMBER, 1834.

[For the Mechanic.]

RAILROADS.

[Braithewaite and Erickson's 'Novelty' Locomotive Engine.]

The above is a correct engraving of the 'Novelty' locomotive, which we mentioned in a previous number, as having created great interest at the trial on the Liverpool and Manchester Railway, in 1830. Its principal recommendations are lightness, speed, and small consumption of fuel. Unlike all the other engines, the tender is a part of itself, notwithstanding which it was much lighter than any of its competitors. On the trial it moved with a velocity nearly double that of the 'Rocket,' and would, undoubtedly, have

carried off the prize, had there been time to have proved it properly before the day appointed for the competition. Its surprising economy of fuel may be conceived from the fact, that the cost of coke was but one half-penny per mile; whereas, the cost for coke for each of the other engines was three half-pence for the same distance.

We have thus far treated of railroads distinct from our own country, but we shall now attempt to give a brief description of the most prominent, either from their extent or from their proximity to us. The Maunch Chunk is the first of any magnitude constructed in the United States; it was built for the purpose of transporting the anthracite coal from the mines of the Lehigh Coal and Navigation Company in Pennsylvania. Its length is 12¾ miles. The Quincy Railroad, near Boston, appears to be next; it was built in 1826, to convey the granite from the quarries, three miles above tide water. The successful operation of this railway caused considerable excitement among the capitalists of Boston, and a number of routes were projected and some surveyed, but none were commenced until 1831. In 1827, the Baltimore and Ohio Railway Company, was chartered with a capital of $6,000,000. It was commenced July 4, 1828; the object was to form a communication between Baltimore and the navigable waters at Wheeling, Virginia, by which the trade with the west would be greatly facilitated. This road has been thus far a very expensive and arduous undertaking; the first thirteen miles, the grading cost $29,000, and the masonry, $17,000; or $46,000 per mile, for merely the foundation for the rails. It was arrested some time from having come in contact with some of the privileges claimed by the Chesapeake and Ohio Canal Company. This, however, has been settled, and the work is progressing.

The Boston and Worcester Railroad was incorporated in June, 1831, with a capital of $1,000,000. The line commences at the south part of the city, and proceeds on the south side of the valley of Charles river to Newton, distance eight miles; two miles beyond this, it crosses a bridge of a single arch with a span of 120 feet, and 35 feet above the surface of Charles river, the cost of which was $6,000. The Clarence pattern rail, of malleable iron, is used upon the whole of this route; the chairs are fastened immediately to the sleepers, which are of chesnut or swamp cedar, laid transversely in well rammed rubble. The cost

of the superstructure is about $6,000 per mile; the grading for the whole is about finished, and the laying of the rails progresses rapidly. The passenger cars run daily to Westborough, 34 miles from Boston, and the whole route to Worcester will undoubtedly be completed next spring. The length is 43¾ miles, 16¼ of which is level, and the remainder is inclined from 13 to 30 feet in a mile.

The Boston and Lowell Railroad was commenced in November, 1831. The length is 25½ miles; the width about 25 feet. There are, on this route, sixty-nine river and road bridges, eighteen under, and fifty-one over the railroad, together with twelve streets crossed on a level. The rails are the kind used on the Liverpool and Manchester road, called the fish-belly, in lengths of 12, 15 and 18 feet, and weigh 55 pounds to the lineal yard; and the chairs 17 pounds each. The rails are supported every 3 feet upon chairs bolted upon stone blocks and sleepers. It enters Boston over a bridge across Charles river, 1,600 feet long. The longest straight line is 3 miles. This railroad will not only be the means of transportation between the extensive manufactories of Lowell and the metropolis, but will also communicate with the navigable waters of the Merrimack, extending to Concord, New Hampshire, distant 50 miles.

The Boston and Providence Railroad, is the third and last railway connected at present with Boston: it was incorporated in 1831, and commenced in December, 1832, with a capital of $1,000,000. The road is graded for a double track, being not less than 26 feet in width, and in many places it is 30 or 40 feet; its length is about 41 miles, and the cost is estimated within the capital. This road is intended to be a portion of the route between Boston and New York. It is said to be the straightest of its length in the world, being in a straight line, 16½ miles. The rail is heavy, being 55 pounds to the yard, and is laid on cedar sleepers. In Canton, over the stone factory pond, the railway crosses a splendid structure 450 feet in length, and from 40 to 50 feet above the natural surface of the pond; it is built entirely of granite, and is called the 'Canton Viaduct;' it contains 15,000 perches of solid masonry, and is justly considered one of the finest structures in the United States.

The Stonington and Providence Railroad was commenced in 1833. It is 48½ miles long, and is intended to

connect with the Boston and Providence Railroad. The cost is estimated at $1,139,414. The Ithaca and Oswego Railroad is the earliest chartered in New York; it is 29 miles in length; capital $300,000. The Worcester and Norwich was chartered in 1832. The distance is 60 miles, on a very favorable route. The Utica and Schenectady was incorporated in 1833, with a capital of $3,000,000. The length is 100 miles, the route is very level, and peculiarly adapted for locomotive power. The Camden and Amboy, extends from South Amboy to Camden, opposite to Philadelphia. The first division, from Camden to Bordentown is 34½ miles in length, and the second division, from Bordentown to Amboy, 26½ miles. The road is a double track, and the expense of the whole route is estimated at $1,466,376·64. There are about one hundred routes, varying from 3 miles to 200 in length.

With the foregoing brief accounts we must close our present subject. We are conscious of many omissions, but our limits will not permit us to do that justice to the perseverance and enterprize of our countrymen which they deserve. We can only acknowledge, that we were unaware, until we entered upon the task, of the extent to which this spirit had been displayed in regard to railways, but although we are surprised, yet it is the surprise of pleasure that we have so much to be proud of, and to be emulated.

PAPER OF THE ANCIENTS.

From the *pith* of the *Papyrus antiquorum*, were formed the papyri of Egypt, found in the sycamore (*Ficus fatua*) coffins, the dormitories of mummies; as well as those recovered from the ruins of Pompeii and Herculaneum. The 'paper reeds by the brooks' are mentioned in the prophetic records, several centuries before our era; the papyrus still clings to such spots among the marshes of Egypt, and the Delta of the Nile; and forms a beautiful ornament on the banks of the Anapus. That found among the swamps, near the ancient Syracuse, seems to be a variety, if not a distinct species; and Mr. Lippi states his having found two species different from the true *Papyrus antiquorum* of mod-

ern botanists. The *Cyperus papyrus* of Linnæus rarely exceeds ten feet in length, which is about that of a specimen in my possession, though Pliny says the root was as thick as a man's arm, and that the plant occasionally exceeded fifteen feet in height. Its stem is imbricated, of a triangular shape, and tapers toward the summit. The head of the papyrus is composed of a tuft of small grassy filaments, about twelve inches long; towards the middle each filament separates into four, and in the partition are four branches of flowers, not unlike an ear of wheat, but forming a soft and silky husk. The flower of the papyrus was used in ancient times in religious ceremonies. This celebrated plant supplied the paper or writing material of ancient times; and in the natural history of Pliny, we are supplied with a description of the process employed for making paper: the papyrus was separated into thin slices by a fine point, these were brought into contact by their edges, transverse slips were again superposited on them, with their edges in similar contact; this done, the mass was sprinkled with Nile water, and submitted to pressure. This ancient paper, which became an important branch of Egyptian commerce, especially with the Roman empire, and in the reign of Augustus, we have every reason to believe was thus formed. If we hold up a specimen of Egyptian papyrus, between the eye and the light, the ribs may be seen parallel, and crossing each other at right angles. Specimens of modern papyri have been manufactured by the Chevalier Landolina, of Syracuse, by a process similar to that described by Pliny, in which the medulla, or pith was employed, *not* the external rind of the reed, as has been generally supposed. The paper formed from the paper reed was in high estimation in the time of Alexander the Great. Ptolemy Philadelphus, King of Egypt, when he commenced his library, and collected an immense variety of books, had them copied on this kind of paper. In his reign, considerable quantities of the paper were exported; which was, at length, however, prohibited, to prevent the King of Pergamus from establishing a rival library. Paper made from the papyrus was principally manufactured at Alexandria, and the city was considerably enriched by the exportation of this paper. Vopiscus mentions one Fermies, who boasted that he could maintain an army from the value of his stock of paper. When it began to be disused is not certainly known; as late as the fifth

century it was in general use in Europe; and in Italy and France was continued to the eleventh and twelfth centuries.

In the buried cities of Herculaneum and Pompeii, which have, by their discovery given as it were, a view even of the domestic manners of the old Romans, numerous rolls of papyrus books have been found; by which the modern papyrus has been satisfactorily identified with that with which we are acquainted.

LEARNING A TRADE.

THERE are many people who dislike the name of *mechanic*, and who would, rather than put their children to an honest trade, tug hard at their business and live sparingly for the purpose of giving them a college education. They think meanly of him who wears the leather apron, and is not dressed up in finery and show. This we believe is the reason why there are so many pettifoggers and vagabonds in the world. Many a son has been sent to college with the expectation of his parents highly excited, but like the fable of the mountain, he produced only a mouse. We think highly of our colleges and literary institutions, and rejoice to see them prosper; but we are more pleased to see an individual's mind turned in a right current. There are hundreds of lawyers who would have made better mechanics; and have obtained a more comfortable livelihood. And we have no doubt, there are many mechanics who would stand high at the bar, had they been blessed with a liberal education. But if a child have talents, they will not remain hid; and no matter what his trade or profession is, they will sooner or later burst forth. There are many distinguished individuals in the literary world, who were bred to mechanical trades. Many of the editors of our best conducted journals were mechanics, and do credit to the stations they occupy. And our mechanics too, generally speaking, are the most industrious part of the community. They are almost always busily employed. But it is apt to be otherwise with professional men. They are often dilatory, lazy. It is an effort for them to bend their minds to a difficult pursuit. They are well informed, because they spend much of their time in reading; but

this is an unprofitable business, unless we have some definite object in view.

In these remarks we wish it not to be understood that we think lightly of professional men generally; for we do not. We wish to address ourselves particularly to those parents who are hesitating what occupations to give their children. Are they ingenious, fond of mechanical pursuits? Give them a trade. Do they love to study, and cannot give their attention to anything else? Send them to college. Let your children choose themselves what trade or profession they will follow; and what *they* select will generally prove the most advantageous in the end. But never think a trade too humble for your son to work at, nor a profession too important for him to acquire. Let every parent pursue this course with his children, and we are confident there would be less unhappiness and misery in the world. You can never force a trade or a profession upon a child; it must be natural to him. A disregard of a child's inclination in this respect has often proved his ruin, or at least, unfitted him for the duties of life.

HUMAN STRENGTH.

One of the most singular and inexplicable experiments relative to the strength of the human frame, is that in which a heavy man is raised with the greatest facility, when he is lifted up the instant that his own lungs and those of the persons who raise him are inflated with air. This experiment was, I believe, first shown in England a few years ago by Major H., who saw it performed in a large party, at Venice, under the direction of an officer of the American navy. As Major H. performed it more than once in my presence, I shall describe as nearly as possible the method which he prescribed. The heaviest person in the party lies down upon two chairs, his legs being supported by the one and his back by the other. Four persons, one at each leg and one at each shoulder, then try to raise him, and they find his dead weight to be very great from the difficulty they find in supporting him. When he is placed in the chair, each of the four persons take hold of the body as

before, and the person to be lifted gives two signals by clapping his hands. At the first signal he himself and the four lifters begin to draw a long and full breath; and when the inhalation is completed or the lungs filled, the second signal is given for raising the person from the chair. To his own surprise, and that of his bearers, he rises with the greatest facility, as if he were no heavier than a feather. On several occasions, I have observed that when one of the bearers performs his part ill by making the inhalation out of time, the part of the body which he tries to raise, is left as it were behind. As you have repeatedly seen the experiment, and have performed the part both of the load and the bearer, you can testify how remarkable the effects appear to all parties, and how complete is the conviction either that the load has been lightened or the bearer strengthened by the prescribed process. At Venice the experiment was performed in a much more imposing manner. The heaviest man in the party was raised and sustained upon the points of the forefingers of six persons. Major H. declared that the experiment would not succeed if the person lifted were placed upon a board. He conceived it necessary that the bearers should communicate directly with the body to be raised. I have not had an opportunity of making any experiments relative to those curious facts; but whether the general effect is an illusion, or the result of known or new principles, the subject merits a careful investigation.

[Compiled from the American Magazine.]

GLASS MANUFACTURE.

The period of the invention of glass is unknown. Although the most ancient manufactories of glass on record were at Tyre, it is certain that the art was known to the ancient Egyptians. Small pieces of blue glass, resembling turquoise, have been recently discovered in ancient tombs at Thebes, which were probably used in glazing the earthenware beads often found adorning mummies, and which have been erroneously cited as made of glass. In later times, glass was made at Alexandria, and was supplied from that city to the Romans as late, at least, as the reign of

Hadrian. The manufacture had been introduced into Rome, where the glass-makers had a particular street assigned to them. Its principal use, at that time, was in making bottles and ornamental vases, in which the skill of the workmen appears to have been very great, though the material is usually thick and colored. We have no testimony that it was used in windows till the time of Lactantius, in the beginning of the fourth century, who compared a penetrating mind to one looking through a glass window.

This art is said to have been known to the ancient Britons, before the coming of the Romans. The supposed Druidical rings occasionally picked up in England have often been mentioned in proof; and if genuine, they show that the art must have made considerable progress among the ancient inhabitants of England. But after the arrival of the Saxons, this art was lost, in that country, for a period of near two thousand years.

During these times, the manufacture of glass appears to have been confined to Italy or Germany. Venice became particularly celebrated for the beauty of its material, and the skill of its workmen; and as early as the thirteenth century, its manufactories supplied the greater part of the glass used in Europe.

The manufacture of glass is now said to have attained a greater degree of perfection in England than anywhere else. Mirrors can be obtained in London exceeding thirteen feet by seven, while no other manufactories make any approach to such a size, except that of St. Ildefonso, in Spain.

The basis, or principal material of glass is *silica*, which forms a considerable portion of many stones, and is almost the sole ingredient of crystal, flint and other pure varieties of quartz. Silica, alone, is infusible in the greatest heat of a furnace; but by the addition of an alkali, as soda, or potash, it will melt, without losing its transparency, and thus is made into glass.

The process of making flint glass is as follows:—The finest white sand is selected, and thoroughly cleansed from all impurities by washing, and then mixed with soda or potash, in different proportions, from a half to a third, according to the quality of the glass required. Some other ingredients are added, such as red lead, arsenic and manganese, to make the glass more perfect. The mixture is

then placed in a furnace and heated as long as vapor rises from it. The mass must be stirred in every direction, the whole of the time, with an iron rake or scraper. The imperfectly agglutinated mass thus formed is called frit. This is next conveyed to the glass furnace, which is built like a dome, ten feet high, and furnished with holes all round, to put in and take out the metal, as the unmanufactured glass is called. When the intense heat of the furnace has rendered the glass fit for working, which the workmen ascertain by trying it, they proceed to work as follows:—An iron pipe, four feet in length, is dipped into the melted glass, a portion of which adheres to the end of it. The workman then blows through the pipe, and the soft glass swells out like a bladder. Then by swinging it in the air, or rolling it on a table, it is dexterously made to assume the form of a bottle, tumbler or other vessel. By simple means, and few tools, as shears, &c., the neck of the bottle, or the rim of the tumbler, is smoothly formed. But when square, flat, or other irregular shaped vessels are to be made, a mould is prepared, and the glass is blown within it, so that the glass takes the form of the mould within.

As soon as an article is formed, it is placed in a furnace called the annealing furnace, where it is permitted to cool as gradually as possible. Were the glass cooled all of a sudden, it would be extremely brittle, and liable to crack. Common window glass is at first formed by blowing the glass into a thin round globe; after which, the blow-pipe being taken from the place where it is blown into, which of course, leaves a hole, it is fixed on the other side of the globe. Then by whirling the globe in the air, the hole enlarges, and the globe spreads out into a flat piece of glass. The place where the rod was last fixed leaves a rough thick place in the glass, called a *bull's eye.* The same is seen at the bottom of a bottle, where the blow-pipe was fixed, in forming the neck, after it had been blown into at the neck.

Plate glass is cast on metal tables; and of this, the best and largest looking glasses are formed. The melting pots in this manufacture are very large, and the glass is conveyed to the tables in cisterns, which are dipped into the pots, and drawn quickly to the casting table, on which the melted glass is poured. A heavy roller is passed over the glass, to spread it level upon the table. Glass made in this

way is clearer, and freer from flaws and veins, which are seen so often in blown glass. Glasses thus cast must be ground and polished, and this alone must make them considerably more expensive.

[From the Journal of the Franklin Institute.]

PATENTS.

PATENT *for Bellows for Smiths' Forges*, and other purposes; George Lewis Dimfel, city of New York. An alien, who has resided two years in the United States; May 23.

The claim annexed to the specification of this patent is in the following words:—'And I, the said George Lewis Dimfel, do hereby declare that I do not mean to claim as my invention, any of the parts of the said bellows taken separately, the same being generally known. But I claim as my invention, the shortening of the rock-staff board near the throat; the adding a second, or short body board, with two additional valves, in such a way that the descent of the weight adds to the quantity and equality of the blast; and the general arrangement and combination of the same, for giving a more equal and effective blast of air, as herein substantially set forth and described.'

The arrangement we believe to be new, and well calculated to attain the end proposed.

PATENT *for an improvement in the mode of Cutting out Shoes*; Charles Weston, Salem, Essex county, Massachusetts, May 27.

Knives are to be made in the various forms required for the leather of the shoe, and with these, fixed to proper blocks, the upper leathers and soles are to be stamped, or cut out.

How old this contrivance may be, we cannot tell; but this we know, that the same thing was patented here twenty years ago, and again about six years since, and also that it has long been in use in Europe. The present patentee is probably not aware of this, but when the thing was patented six years since, the applicant was informed of it, and the the machine exhibited to him; on being told that he could not sustain the patent, he replied, 'but I can sell rights.'

PATENT *for an improvement in the Application of the Bellows in Smith's Forges;* Ransom Green, Brunswick, Rensselaer county, New York, May 31.

It is proposed to make the forge in the form of a box, which may be three feet square at top, and of the usual height of a forge, the place for the fire being near one edge of the top of the box. The bellows is to be within the box, and its pipe is to be introduced into an iron cylinder, which may be twenty inches in height, and ten in diameter, which cylinder is directly under, and extends up to the forge fireplace. At the top of it may be a pan, with grate bars, when a diffused blast is required, or the blast may be led in through a pipe on the side, when a concentrated blast is required, as in the using of bituminous coal and charcoal, for welding, &c.

The claims are to 'the manner and principle of using grates for burning coal in forges. The manner and principle of communicating air from the bellows into a cylinder or other cavity, so as to apply it in a diffusive manner. The manner and principle of changing this diffusive application of air to one more concentrated. The manner and principle of placing the bellows within the box of the forge; and also the right of applying any of them to forges now in use.'

We have a portable forge in which the bellows is situated like that represented in the drawing of this patent, but not with the cylinder, or cavity; and we have seen forges in which the wind is diffused by passing into a chamber beneath the fire, and then up through a grate.

PATENT *for a Horse Power;* invented by Joel Eastman, late of New Hampshire, deceased. Patented by his administrator, John Martineau, of Eldridge, Onondaga county, New York, May 31.

This is a very ingeniously contrived apparatus, the invention of a gentleman whose talent for mechanics was of no ordinary kind, and who, had he lived, would probably have found but few equals in a department in which our citizens may be said to excel. His premature death was a real loss to his country, while those estimable moral qualities by which he was distinguished, left a void, not easily filled, in the bosoms of those who knew him intimately.

In this machine there is a stationary wheel placed horizontally on a suitable bed, or frame. This wheel has teeth on its inner rim, pointing towards its centre. The lever by which the horse is to draw crosses the upper side of this fixed wheel, and has, on its lower side, two (or three) smaller wheels, which drop within, and gear into, the teeth of the fixed wheel, and also into a pinion standing between them, on a shaft in the centre of the fixed wheel. On the lower end of this central shaft there is a crown wheel which gears into, and drives a pinion upon a horizontal shaft, through which motion is to be given to any machinery.

The claim is to the stationary wheel, combined with the smaller wheels which gear into it, and to the pinion in the centre; 'the improvement effected by which arrangement, is the advantage of bringing cogs into action on opposite sides of the journal of the pinion, by means of which the stress is taken off the journal, and two or more cogs being brought into action at the same instant, the stress is divided and distributed; thereby diminishing the liability of breaking the cogs; and in fact, doubling the strength by this arrangement, where the cogs are of the same size, and trebling it if three wheels are used. Another advantage resulting from this arrangement, is compactness and portability. These and all other advantages that are derived from this application of the foregoing described combination, however the same may be modified in practice, is claimed in trust for the heirs and legal representatives of the aforesaid lately deceased Joel Eastman.'

[From the Journal of the Franklin Institute.]

INFORMATION IN RELATION TO PATENTS.

The persons to whom patents may be granted, by the several laws of Congress, are citizens of the United States, aliens who have resided two years in the United States, and those who, not having resided two years, shall have declared their intention to become citizens of the United States, at the expiration of that period. A patent of this last description becomes void, if the invention is not introduced into public use in one year, or if for a period of six months after such introduction, it shall not continue to be

publicly used in the United States, or if the applicant fails to become a citizen of the United States at the earliest period at which he may be entitled so to become.

Official Notice to Persons having business at the Patent Office.

The Patent Law directs that 'every inventor, before he presents his petition to the Secretary of State, signifying his desire of obtaining a patent, shall pay into the Treasury thirty dollars; and shall take duplicate receipts, one of which receipts he shall deliver to the Secretary of State when he presents his petition.'

It has been the practice, in many cases, to send the money above-mentioned to the Secretary of State, or to the Superintendent of the Patent Office; but, in future, all applicants for patents will conform to the directions of the law on the subject, and make the required payments into the Treasury.

It will be a compliance with the law, in this respect, to pay the money to the Treasurer of the United States at Washington, or to his credit in any one of the selected Deposite Banks. The receipts should state by whom the payment is made, and for what object.

It has also been the practice to transmit to the Patent Office papers describing new inventions and improvements, which the inventors have not yet completed, or for which they are not prepared to take out patents; and it has been erroneously supposed by those inventors, that by filing such papers in the office, they would prevent any other persons from obtaining patents for the like inventions or improvements. Sometimes the persons sending such papers have claimed to have them received as their private property, and as not liable to be seen by any one, except with their consent.

Caveats not being recognized by the patent laws of the United States, no papers will hereupon be received under such a claim; and those which have been heretofore deposited, if permitted to remain, will be open to public inspection. Persons, therefore, who have transmitted to the Patent Office, papers relating to inventions or improvements, unaccompanied by applications for patents for the same, which papers they claim as their private property, and as not subject to be seen by others, are requested to withdraw them.

JOHN FORSYTH, *Secretary of State.*

Department of State, Oct. 3, 1834.

The Editor of the Franklin Institute publishes the following notice in relation to this subject.

In the number of this Journal for November, 1828, vol. 2, new series, p. 332, we published the circular of the Patent Office, giving 'Information to persons applying for Patents, or transacting other business at the Patent Office. The information then given has been remodeled by the Secretary of State, as will be seen in the preceding articles. This had become necessary in consequence of the passage of certain laws upon the subject, since that circular was issued, and also in consequence of some alteration directed to be made in the manner of transacting the business of the office, particularly as respects the payment of the Patent fee, and the disposition of papers lodged in the office by inventors, previously to their being prepared to obtain patents, and usually denominated Caveats. Such papers were formerly kept private upon a request being made to that effect; they are henceforth, if placed on file, to be open to the inspection of those who wish to examine them, and will, therefore, be considered in the nature of public notices that the thing described has been invented by the individual named in them.

The change which has been made in the manner of paying the Patent fee, in order to make it conform with the legal provisions upon this subject, will be attended with considerable inconvenience to persons residing at a distance from any Deposite Bank. Several persons have, in consequence, transmitted the money to the Editor, for the purpose of having it paid into the Treasury of the United States; and he will very cheerfully transact this business for any of his correspondents, provided their letters come free of postage, and the money is such as will be taken in the Bank of the Metropolis, in Washington. As no fee will be charged for this, the whole transaction must be at the risk of the person remitting the money; the offer is made for the accommodation of those in whose pursuits the editor feels an interest, and is therefore willing, at the expense of a little trouble to himself, to relieve them from the difficulty above noticed; his residence in Washington, connection with, and proximity to, the public offices, enabling him to do so.

[From the Western Magazine.]

STEAM-BOATS ON THE WESTERN WATERS.

In a publication made by the writer of this article in 1829, on the interesting subject of steam-boats, it was calculated that from the time of their first introduction on the western waters in 1811, until that period, their number amounted to about three hundred and twenty-three. Their united tonnage was estimated at fifty-six thousand tons. From the best data which could be procured from the most intelligent sources, the original cost of these boats was five millions six hundred thousand dollars, and the repairs on the same number, assuming that none of them would last longer than 1832, was set down at two millions eight hundred thousand dollars. Now, although there were five or six boats built between the years 1811 and 1817, the latter period may be assumed as the epoch of their regular and successful introduction; in 1825, they were brought to their present state of perfection. It results, then, that the amount expended for the building and repairing of steam-boats, in a period of about eleven years, was equal to eight millions four hundred thousand dollars. As the number of steam-boats was increasing yearly, no fixed amount can easily be assumed for the yearly expenses, but for the year 1829, the sum was fixed at two millions five hundred thousand dollars; if, then, five hundred thousand dollars be considered as a fair yearly average from 1818, the total amount of money expended on the shores of the western waters, up to 1829, inclusive, will be little short of fourteen millions of dollars. When it is considered that this circulation and expenditure of money was exclusively created by the introduction of the steam-boat, the importance of this invention to the Valley of the Mississippi may be conceived. It has produced an advance of prosperity that would have required more than a century to have realized in the ordinary progress of human affairs; it has produced a revolution in business little inferior in importance to that which followed the discovery of the art of printing.

On the first of January, 1834, an official list of steam-boats, from an authentic source, gives the whole number of two hundred and thirty, whose aggregate amount of tonnage is equal to about thirty-nine thousand tons. Allowing the cost of building at a rate much lower than the rule

adopted three years since, the capital now invested in this stock will exceed three millions of dollars. The expense of running may be put down nearly as contained in the following scale:

60 boats over 200 tons, 180 running days, at $140 per day,	$1,512,000 00
70 boats from 120 tons to 200, 240 running days, $90 per day,	1,512,000 00
100 boats under 120 tons, 270 running days, $60 per day,	1,620,000 00
Total yearly expense,	$4,644,000 00

This sum may be reduced to the different items producing it in the following proportions, viz:

For wages, 36 per cent., equal to,	$1,671,840 00
For wood, 30 per cent., equal to,	1,393,200 00
For provisions, 18 per cent., equal to	855,920 00
For contingencies, 16 per cent., equal to	743,040 00

This result is truly striking to those who were accustomed to the state of things on our rivers within twenty years. The difference in the amount of wages paid, is in itself very considerable; but the item of fuel is one created exclusively by steam-boats; and when it is considered that nearly one million and a half is expended every year, at a few points on the Mississippi Valley, it presents a vast field for speculation. The immense forests of beech and other timber unfit for agricultural purposes, were, before, not only useless, but an obstacle to the rugged farmer, who had to remove them before he could sow and reap. The steam-boat, with something like magical influence, has converted them into objects of rapidly increasing value. He no longer looks with despondence on the denseness of the trees, and only regrets that so many have already been given to the flames, or cast on the bosom of the stream before him.

At the present period, the steam-boats may be considered as plying as follows, viz:

25 over 200 tons, between Louisville, New Orleans, and Cincinnati, measuring	8484 tons.
7 between Nashville and New Orleans, measuring	2585 "
4 between Florence and New Orleans,	1617 "
4 in the St. Louis trade,	1002 "
7 in the cotton trade,	2116 "
57 boats not in established trades, from 120 to 200 tons,	8641 "
The balance under 120 tons in various trades,	14,655 "
	39,000

In the New Orleans and Louisville trade, the boats over two hundred tons make about one hundred and forty trips, in prosperous seasons; those of smaller size make from fifty to sixty trips. But to go into an estimate of the number of voyages made by the boats in the different trades, is impossible, because no regular data are furnished, and the result depends upon a variety of contingencies.

Previous to the introduction of the steam-boat in 1817, about twenty barges, averaging one hundred tons, afforded the only facilities for transporting merchandise from New Orleans to Louisville and Cincinnati. These making but one trip within the year, gave the means of bringing up only two thousand tons. The present tonnage in this trade exclusively, having been stated to be 8484 tons, gives the amount employed, amounting to one hundred and forty trips in the season, to be 1,187,760 tons; a cause capable of producing a revolution in sixteen years hardly equalled in the annals of history. The effects of these causes upon western commerce have necessarily been immense. The moral changes alone are felt throughout the west, and the effect on prices is almost incalculable; the imported article has fallen in a ratio equal to the increased price of western products. In looking back to the old means of transportation, we cannot conceive how the present demand and consumption could have been supplied by them.

To those who are acquainted with the early mercantile history of our country, when it was no uncommon thing for a party of merchants to be detained in Pittsburgh from six weeks to two months by low water and ice, the existing state of things is truly gratifying. The old price of carriage of goods from the Atlantic seaboard to Pittsburgh, was long estimated at from five to eight dollars for one hundred pounds. We have instances in the last five years, of merchandise being delivered at the wharf of Cincinnati, from Philadelphia, by the way of New Orleans, for one dollar per hundred.

It may not be useless, or uninteresting, to give an idea of the *mortality* among steam-boats in a given time. It is not pretended that any decided inference can be drawn from this statement, or that the facts go to establish any fixed rule. But under the present situation of steam-boat discipline and regulations, a tolerably fair conclusion can be drawn from it. Taking the period, then, of two years from the fall of 1831 till that of 1833, we have a list of boats

gone out of service of sixty-six; of these, fifteen were abandoned as unfit for service, seven were lost by ice, fifteen were burnt, twenty-four snagged, and five destroyed by being struck by other boats. Deducting the fifteen boats abandoned as unseaworthy, we have fifty-one lost by accidents peculiar to the trade. In number, this proportion is over twelve per cent. per annum; in tonnage, the loss is upwards of ten per cent. Amount snagged, 3721 tons; amount burned, 2330 tons.

The foregoing calculations and statements afford great field for speculation. It is evident that there is a vast amount of surplus tonnage, and, of course, the business at present is entirely overdone. Indeed, from a full investigation of the subject, a few years since, by a committee appointed for the purpose, it was fully ascertained that, although the benefits conferred on the Valley of the Mississippi were incalculable, the stock invested in boats was, as a general rule, a losing investment; in many cases, a total sacrifice. In a few cases, owing to a fortuitous combination of circumstances, money has been made; but the instances are so few as not to affect the rule. Time may correct this evil; but in a business in which public interest and public safety are so much concerned, a little governmental interference and assistance might be useful, and ought to be tendered. Some legislative action, which might tend to arrest the fearful increase of accident, has long been a desideratum; but how this is to be applied, presents the great difficulty. An experiment, however, has been tried, which seems to hold out the prospect of success. We allude to the company which was formed in 1832-3, called the Ohio and Mississippi line of transportation. During the existence of this company, not an accident of any kind occurred to person or property. A perfect regularity in arrivals and departures was introduced, and as all the good boats were in the same interest, there was no foolish rivalship, and consequently, no injudicious racing. How far the post-office department would be justifiable in aiding such an association, we do not pretend to say; but in our humble view of the case, we consider the great interests of the west are much involved in the question; and when the great uncertainty and irregularities of the mail, which have hitherto distinguished the routes between New Orleans, Natchez and St. Louis, and Pittsburgh, Louisville and Cincinnati, are considered, something is

expected. On the score of economy alone, the subject is worthy of the reflection of the general government. Probably nine-tenths of the correspondence on the western waters is of a commercial character; the greatest portion of this is now transmitted, free of postage, by the means of passengers: no one can prevent this. If a line of steam-boats can be made interested in protecting the government, the general post-office would find it to its advantage to give liberal terms to such an establishment. N.

CHINESE PRINTING.

A number of the Chinese Repository contains an article under this head, in which the *metallic movable types* proposed by Rev. Mr. Dyer, of Penang, are described. For 900 years, the Chinese have printed from wooden blocks about one half an inch thick, upon each of which a facsimile impression of two pages, constituting one leaf of the work to be printed is taken, and then the characters cut in the block. One of these pages of ordinary size may be cut in a day, and the block is uniformly cut on both sides. The ink is applied with a brush, the paper laid on and gently pressed with another brush; and one man in a day will take off 2,000 copies.

The *Chinese metal types* will resemble English *logo-types*, each type containing a complete word; for in Chinese one character expresses not a letter or syllable, but a complete word or idea. Mr. Dyer thinks it very desirable that they should have *a worker of steel on the spot*, who shall immediately commence cutting punches or matrices, in which the type may be cast as shall be needed. He believes it will be economy in the end, though at first it will require great expense and enterprise, as the number of characters is very great. The *mass* of the language is not much more than *twelve hundred characters* in variety; but it would require several thousand to make the fount tolerably complete.

By this means, any work requiring despatch, like a newspaper, might be issued in as many *hours* as the Chinese method would require *days*. Many pages might be combined in a single form, and printed at one stroke of the

press; and the type will be far more durable than the Chinese block, from which only from 10 to 30,000 impressions can well be taken.

By the Chinese method, however, letters of all sizes, and figures of all descriptions may be cut without difficulty on the same page, whereas, as many founts of type would be required as there are type of different sizes; and the apparatus in the Chinese method is far more simple. Every instrument necessary for printing on a small scale may be packed up and carried on a workman's back.

The 'Scripture Sleeve Gem,' published in China at the expense of the American Tract Society, contains two thirds as many characters as the Gospel by Mark, being fifty-four leaves in about the 32mo size. The cost of the blocks for this work was ten dollars; the cost of the printing and paper for 3,000 copies was thirty dollars, or one dollar per 100. We are not informed whether this includes folding, stitching, &c.

In view of all the above, while it appears that movable metallic types would be useful for printing ephemeral productions, yet we are constrained to inquire if *stereotyping from the Chinese blocks* would not at once afford the highest facilities for the publication of all permanent works. We expect further information ere long upon this point.

[For the Mechanic.]

STEAM.

Steam is vapor produced from water at a high temperature. Vapor rises from water at all temperatures; only from the surface and very slowly, till the water is heated. When water is dried up, as the common expression is, it is converted into vapor; and the hotter it is, the faster it dries away. The hotter vapor is, or rather the hotter the water is from which it is made, the more elastic it is; and when the water is boiling hot, its elastic force is equal to the pressure of the atmosphere; and then it is formed at the bottom of the water and rises through it, and the agitation of the water caused by the vapor forcing its way through the water is called boiling.

At the common pressure of the atmosphere, one cubic inch of water produces nearly a cubic foot of vapor, (or 1700 times as much.) According to the experiments of Dr. Ure, of Glasgow, the elasticity of steam at 212°, is equivalent to the pressure of a column of mercury 30 inches high, and is, therefore, equal to the atmospheric pressure. At higher temperatures, the elasticity increases much more rapidly than the heat itself. Hence, in a steam-engine, it will not require double the amount of fuel to produce steam of double force.

It is said that one pound of Newcastle coal will convert seven pounds of boiling hot water into steam; and that it will take six times as long to convert boiling water into steam, as it would to bring the same quantity of ice to a boiling heat.

The quantity of steam which is produced in a boiler depends upon the surface of water which is exposed to the fire; hence various contrivances have been made for making the fire come in contact with a great portion of surface of the boiler in which the water is contained. Boilers formed of tubes are considered by some as advantageous, not only in this respect, but also in point of safety, for the same pressure of the steam will not be so great upon any particular part of the boiler. But a boiler of this construction will be more difficult to clean, as well as more liable to danger from obstruction and foulness.

When water is exposed openly to the atmosphere, it can never be heated hotter than 212°, for all the heat which the fire gives to it is carried off by the steam; and the hotter the fire, the faster the steam is produced. But when the steam is prevented from escaping, unless by overcoming great pressure, as in the steam-engine, any heat which fire can produce can be given to the vapor, and its force or elasticity will be increased in a very high degree. In this way, Mr. Perkins, a celebrated experimenter on the properties of steam, is said to have heated water red hot, and the force of pressure which is exerted must have been tremendous.

It is probably well known that water is repulsed from very hot iron. If a few drops of water be dropped upon a moderately hot iron, heated not much above 212°, the water will boil rapidly and soon be gone. But if the iron be much hotter, the water will not spread out on the iron, but will roll about on it in perfectly globular drops, hardly

touching the surface of the iron, and will evaporate more slowly. When hotter still, the water will be thrown violently from the surface of the iron.

This phenomenon is caused by the extremely rapid formation of steam on the under side of the water, which throws it from the iron, or rolls it over, in order to have room for escaping. A most singular fact developed in Mr. Perkins's experiments was, that the water, when thus violently heated, would not escape through a small hole in the vessel which contained it. This very singular circumstance seems to arise from the same cause as the above explained phenomena. The whole of the water in the vessel must have been, in fact, converted into steam, but not having any room to expand, was as dense as the water itself; and steam of a high temperature compressed to the density of water must require an enormous force to resist it. It is supposed that, in this experiment, the heated water did not actually touch the inside surface of the containing vessel, and that it could not pass out at the hole, from its smallness, without coming so near the iron as to be repelled back. But when, after the hole was opened in the vessel, the heat was lowered, the water spirted out with great violence; as we see it do from the guage cocks of a steam-boiler.

[From the Southern Planter.]

SILK.

Mr. Editor:—As the culture of silk is becoming of considerable importance in our country, it may not be altogether uninteresting to some of your readers to present them a few remarks concerning its early history.

Previous to the sixth century, the art of rearing silk worms was unknown in Europe. Some small quantity of silk stuffs had been brought to the Italian states, from Asia, but only persons of the first rank were able to procure them. Some idea may be formed of their scarcity, and the great estimation in which they were held, from the fact that, in ancient Rome, under Aurelius, A. D. 270, a pound of silk was considered equal in value to a pound of gold.

In the sixth century, Justinian introduced the art of rearing silk worms into Greece, which rendered the commodity somewhat more plentiful; yet the supply was greatly inadequate to the demand, and it continued an article of luxury and magnificence, reserved for persons only of the first order, or for public solemnities.

This is the first of its culture in Europe, and it was not until the beginning of the twelfth century that it was carried into the neighboring countries—a proof of the averse disposition of mankind to depart from the 'beaten track of life.' In the year 1130, Roger I., king of Sicily, carried off a number of artificers in the silk trade, from Athens, and, settling them in Palermo, introduced the culture of silk into his kingdom, from which it was communicated to other parts of Italy. From this period, silk increased in plenteousness throughout Europe, and, in the sixteenth century, silk worms were introduced into this country. Thus, an article which was originally confined to the half civilized countries of Asia, has at length become diffused over Europe and America, promoting the comfort and prosperity of the people. B.

A STITCH IN TIME SAVES NINE.

A CERTAIN order of men are expert at fixing new texts to old sermons. I will reverse the rule, and fix a new sermon to an old text. 'A stitch in time saves nine,' is as true out of doors, as within.

When a board gets loose on the side of your barn, if you suffer the cattle to run in their heads and widen the breach, or the rain to drive in upon your hay and grain, the loss will convince you, that 'a stitch in time saves nine.'

When I see a farmer pass by a gap in his stone wall, or a broken rail in his fence, I conclude he is only tenant at will, and his cattle the landlords. He would do well to consider, that 'a stitch in time saves nine.' A minute's work may save a bushel of corn.

Surveyors of highways might profit by my text. One hour's labor, in the spring, might prevent the necessity of a dozen in the summer. On descending ground, dig drains

to draw the water into the adjacent fields; make the road highest in the middle; let it be so wide, that when the sides are gullied by a shower, there may be room for a cart to pass without turning over.

This is much better than the 'do for the present' way of flinging out the loose stones, and making the centre of the road a channel for the torrent, and a pit for the benighted traveller.

My text holds true in politics and morals, as well as in economics. When the rude hands of rebellion begin to pick the constitution to pieces, and shake the fist in the face of lawful authority, as much as to say, down with this house—'a stitch in time will save nine.' The rod applied to one bad man's back, may sometimes save the throats of twenty good men from the knife.

A youth, who is running into bad habits, should be checked in season. Ill habits are tenacious and insinuating—'give an inch,' and they will 'take an ell.' When they have made a breach in the morals of your child, remember that 'a stitch in time saves nine.'

A few hours confinement in your closet, with a little sea sonable reproof, may save your son a year's imprisonment, or confinement in the castle; and the discipline of the whip, in private, may prevent the necessity of using the cat o'nine tails in public.

MISCELLANY.

ANCIENT ART.—Dædalus, a very ancient sculptor, of whom the Greeks make mention, is said to have made walking statues, by the traditional fables of Greece. It is supposed that by this was meant that he made the limbs separate, whereas other artists had only carved their outlines on the block of which the statue was made. The art of sculpturing, or carving, is of great antiquity, and in Greece, was, very early, carried to a high degree of perfection. In almost every nation, however rude, we find some attempts at imitations of this kind, in the uncouth images of their gods. Painting, to a considerable extent, was practised among the Mexicans, as a means of recording past events, by representing them in pictures, they having no system of writing.

EXPLOSIONS.—Lately, we saw an account of the explosion of the engine of a locomotive steam-carriage, on a railway, in some southern or western portion of our country. It was mentioned as being the first explosion of *this kind* that had been known. Why is it—we have often asked ourselves, before this—that explosions are so frequent on board steam-boats, while the engines of locomotive, or railway carriages seem to be comparatively free from this danger? Why cannot the one be made as safe as the other? We ask those who understand these things better than we do, to explain the matter.

MANUAL LABOR SCHOOLS.—If there is anything in the course of the operations of the day, calculated to bring the different branches of mechanical labor into that repute and give them that rank in the scale of respectability which they ought to have, it is certainly these institutions. They are rapidly multiplying in our country, and ere long, if we judge rightly, some system of combining labor with study will be put into operation in all our public places of education. They ought, without doubt, to be encouraged. They are connected with some important principles, to which we are authorized to look in part, for the preservation of morals and sound institutions. They are calculated to train up a sounder, healthier and more vigorous race of learned men, than have heretofore been the upholders of science and literature. And if such a race of men may, by any means, be raised up, what have we to expect, but sounder philosophy and morals, more vigorous efforts in the promotion of religion, literature, science and education generally, which, under the direction of a wholesome religious influence, will be of the highest importance and usefulness to our country.

HEAT AND LIGHT.—The question whether these are one and the same or separate agents, has excited much research into the laws of nature. It is generally admitted, we believe, at present, that they are different. Will not some ingenious correspondent favor us with a dissertation on this interesting subject? We have seen the remark, lately, that the *solar* heat was different from the heat of a common fire; and the following experiment was adduced in proof of the position:—Place a plate of glass between yourself and the sun, (or stand against a window,) and you will feel the heat equally with the light; but a glass interposed before a fire will not suffer the heat to pass.

Color of the Sky.—The farther we ascend from the surface of the earth, all other circumstances being the same, the deeper is the color of the sky. The color of the sky is quite generally attributed to the atmosphere itself, which being a material substance, has, therefore, some power, however slight, to resist the passage of the sun's rays, and to reflect them. The most transparent of glass will, if accumulated to the thickness of one or two feet, present quite an impervious medium to the passage of light. On the other hand, most substances, provided they can be made sufficiently thin, transmit some light. Even among the metals, gold, by reason of its high degree of malleability, can be so extended that some light will pass through it. The air then, we have, from this analogy, good reason to conclude, is not perfectly transparent, though at short distances, we cannot perceive that the view through a portion of space exhausted by air is at all clearer.

An instrument called a cyanometer is employed to measure the degree of intensity of blue in the sky. It is a circular card, whose circumference is divided into sixty degrees, and against each degree of which is a shade of blue painted, in regular gradation from the lightest to the darkest. In the tropical climates, the sky is said to be of a deeper color than in the temperate zones. The color of the sky depends much on the absence of vapor, the tint being much more deep and pure when the air is perfectly clear.

Chemistry.—This most interesting of sciences has from time to time been brought before the readers of the Mechanic, but very few think or know how much they are indebted to it for many of the conveniences of life. There is hardly an article in their daily use for which they do not owe something to the chemist. The varnish of their furniture, the dyes of their clothing, the service of their table, their cookery, the very tools with which they pursue their daily occupations, receive their perfection from the hands or the science of the chemist. Without doubt, this, as well as many other sciences of a more or less practical tendency should be made a part of common education. People, especially the mechanics, are, by far too apt to overlook their intimate connection with the sciences. The scientific man, they imagine, is benefitting few or none by his speculations and experiments, by his parade of gases, &c.; it has not entered their minds that he is digging a well, as it were, whose springs are to flow by their doors. They little think that he is benefitting them; whereas if they look around them, they can hardly find a single article on

which his genius has not been successfully employed. And after all this, the mechanic has no time to attend to science,—even the very science on which his business more or less intimately depends.

Great Printing Establishment.—In looking over a file of late London papers, we find an interesting description of the extensive printing establishment of Mr. Clowes, where the publications of the celebrated publisher, Charles Knight, and of the Society for the diffusion of useful knowledge, are printed. There are employed thirty type founders, six stereotype founders, seven men damping paper and one hundred and sixty compositors. The principal composing room, where the type is set, is 270 feet long, and is filled from end to end with a double row of frames. Two steam-engines are employed in driving the printing machines, of which there are eight that can each throw off from seven hundred to one thousand impressions per hour. There are fifteen common printing presses for fine work, and five hydraulic presses, of two hundred and sixty horse power each, for pressing paper. There are in the establishment about one thousand works in stereotype, of which seventy-five are bibles. The first cost of these plates would amount to 400,000*l*; the weight is about 3000 tons, and if melted and sold for old metal would be worth 70,000*l*. The average quantity of paper printed amounts weekly to the astonishing quantity of about two thousand reams. When the paper-makers and other tradesmen are taken into account, the men to which this establishment gives employment must amount to several thousands.

India Rubber Carpets.—Having some India Rubber varnish left, which was prepared for another purpose, the thought occurred to me of trying it as a covering to a carpet, after the following manner:—A piece of canvass was stretched and covered with a thin coat of glue, (corn meal size will probably answer best;) over this was laid a sheet of brown paper, or newspaper, and another coat of glue added, over which was laid a pattern of house papering, with rich figures. After the body of the carpet was thus prepared, a very thin touch of glue was carried over the face of the papers, to prevent the India Rubber from tarnishing the beautiful colors of the paper. After this was dried, one or two coats (as may be desired) of India Rubber varnish were applied, which, when dried, formed a surface as bright as polished glass, through which the variegated colors of the paper appeared with undiminished, if not with increased lustre. This carpet is quite durable, and is impenetrable to water, or grease of any description.

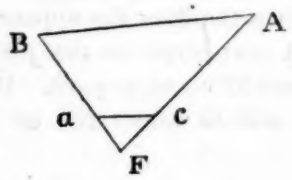
When soiled, it may be washed like a piece of smooth marble or wood. If gold or silver form the last coat, instead of papering, and the varnish is then applied, nothing can exceed the splendid richness of the carpet, which gives the floor the appearance of being burnished with gold or silver. A neat carpet on this plan will cost, when made of good papering, about 37 cents a yard. When covered with gold or silver leaf, the cost will be about 100 or 150 cents a yard.—Lon. Mec. Mag.

New Invention—*The Proverb realized, 'the Cart before the Horse.'*—In the month of May last, there was seen, in the streets of Manheim, a horse pushing before him a carriage, guided with much address by Baron Drais, the author of this invention, which is attended with great advantages:—1. the horse cannot run away. 2. The carriage is not exposed to the dust and dirt generally thrown up by the horse. 3. The prospect is not interrupted by the coachman and the horses. 4. The conversation of the travellers cannot be overheard by the coachman. 5. The travellers are not incommoded by the fumes of the tobacco, &c. The coach-box will be placed on the roof of the carriage, behind, and by means of a looking-glass the driver is able to guide the vehicle. This invention is applicable to carriages drawn by four horses.—Heidelburg, Aug. 15.

Human Strength.—From the result of experiments made in Portsmouth dock-yard, in driving and pressing in large iron and copper bolts, a man of medium strength, striking with a mallet weighing eighteen pounds, and the handle of which was forty-four inches long, would start a bolt about one eighth of an inch every blow. It required a pressure of one hundred and seven tons to press the same bolt down the same quantity of space, but a small additional weight pressed it completed home.

Potato Starch.—Let the potato be taken and grated down to a pulp, and the pulp placed upon a fine sieve, and water made to pass through it; the water will be found to have carried off with it an infinite number of particles, which it will afterwards deposit in the form of white powder, separable by decantation, which powder is starch, possessing all the essential properties of wheaten starch.

ANSWER.



In answer to the question in the November number of the Mechanic, I would say the distance between the two objects is 320·1 rods. My solution is as follows:

The line (B*a*) running northwest to the tree beside the pond, and the line (*ac*) running thence due north, to the bridge across the river, make an angle of 135°. The latter line makes also with the line running from the bridge to the meeting-house an angle of 135°. B*a* and A*c* being produced to F, we have an isosceles right-angled triangle F*ac*, the angles F*ac* and F*ca* being each 45°; hence the sides F*a* and F*c* are easily found. Then we have the right angled triangle, ABF, of which the two sides AF and BF, also the included angle at F, are given, to find the third side, AB, which is found, by a few statements in trigonometry, to be 320·1 rods the distance between the house and the meeting house. E. G.

Our correspondent might have dispensed with reference to trigonometry, which, on account of the necessity of referring to tables, (which cannot always be had) should be done wherever possible.

The hypothenuse of the isosceles right-angled triangle F*ac*, being known, (= 64) the square root of 1-2 its square would give him the side, which being added respectively to the known lines, A*c* and B*a*, would give the sides AF and BF of the triangle BFA. The square root of the sum of their squares would give us the distance required.

In mathematical analysis and solutions there are abundant cases where, by a little ingenuity in stating an equation, or in treating terms or expressions of peculiar form, a vast reduction of labor, and even the overcoming of obstacles which otherwise would have been insurmountable, may be effected. Though the present case is not precisely the same, yet the general reasoning will apply; and it is always well to consider several ways of performing an operation, that the one may cast a clearer light upon the other.

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